

REMARKS

Claims 1-24 are currently pending in the application. Claims 6-23 have been withdrawn due to a restriction requirement made by telephone on April 4, 2007. Applicants herein cancel claim 3 without prejudice. Claims 1 and 24 are in independent form.

Claim 3 is objected to under 37 CFR 1.75(c) as being of improper dependent form. The Office Action holds that it is not clear what claim 3 adds to claim 2 since the cyclic voltammetric electrodeposition of claim 1 appears to require the application of varying electrical potentials. In response thereto, Applicants have canceled claim 3 without prejudice. Reconsideration of the objection is respectfully requested.

Claims 1-5 and 24 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,284,571 to Verbrugge. Specifically, the Office Action holds that the Verbrugge patent is directed to a method of making electrodes for electrochemical cells and discloses a substrate that is a gas-diffusion electrode prepared in the form of an essentially planar carbon electrode. The substrate was contacted with a 10 mM $\text{Pt}(\text{NH}_3)_4\text{Cl}_2$ solution, a voltage was applied, and platinum was deposited. The Office Action holds that Verbrugge applied voltammetrical electrodeposition. Reconsideration of the rejection under 35 U.S.C. § 102(b), as anticipated by Verbrugge, as applied to the claims is respectfully requested. Anticipation has always been held to require absolute identity in structure between the claimed structure and a structure disclosed in a single reference.

In Hybritech Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 231 U.S.P.Q. 81 (Fed. Cir. 1986) it was stated: "For prior art to anticipate under §102 it has to meet every element of the claimed invention."

In Richardson v. Suzuki Motor Co., Ltd., 868 F.2d 1226, 9 U.S.P.Q.2d 1913 (Fed. Cir. 1989) it was stated: "Every element of the claimed invention must be literally present, arranged as in the claim."

Verbrugge discloses three methodologies to electrodeposit metal by using positively charged metal species. The abstract of Verbrugge clearly states that "The method of the invention deposits positively charged metal species, preferably platinum-ammine, at sites where negatively charged sulfonic acid groups of the SPE are in contact with carbon". These methodologies are then elaborated by providing three examples. In example 1, 0.01 M $\text{Pt}(\text{NH}_3)_4\text{Cl}_2$ (a cationic complex) was used by setting a potential at -2 V vs. Ag/AgCl electrode. In example 3, Verbrugge deposited platinum on a glassy carbon surface by rotating disk method with a rotating speed of 1000 rotations per minute by scanning potential from 0 to -0.8 V. Example 3 in Verbrugge's invention was used to document that these electrodeposited materials show hydrogen evolution at potential more negative than -1 V, breakdown of solvent at low metal concentrations, and pointed out the limitation of the use of low concentration of metal cation for electrodeposition. In example 4, a -0.75 V fixed potential was used to electrodeposit platinum again from cationic 10 mM $\text{Pt}(\text{NH}_3)_4\text{Cl}_2$ solution. In fact, half an hour deposition yielded only 0.1 mg/cm² platinum. In other words, Verbrugge discloses conventional electrodeposition through rotating disk electrode voltammetry, and controlled potential electrolysis.

In contradistinction, the present invention requires the use of cyclic voltammetry to **electrocatalyze polymerization** (i.e. electropolymerization) of anionic, cataionic, or neutral platinum complexes on carbon substrates followed by reduction (reductive electropolymerization) to form a uniform thin-film of metal with variable loadings from 0.03 mg/cm² to 0.2 mg/cm². Applicants have amended the presently pending claims to more accurately describe the invention, i.e. coating a carbon article with a metal by electrocatalyzing the polymerization of a metal complex on the carbon article followed by reduction through cyclic

voltammetry, thereby forming a metal coating on the carbon article. The technique of cyclic voltammetry has long been known to electrochemists; however, Applicants have used herein a nonconventional method that was previously not expected to work. Applicants used this technology to electrocatalyze platinum metal complexes to form polymeric species to uniformly coat carbon substrate followed by reduction to make a thin-film.

See MPEP 2163.07 II: "An amendment to correct an obvious error does not constitute new matter where one skilled in the art would not only recognize the existence of the error in the specification, but also recognize the appropriate correction. *In re Oda*, 443 F.2d 1200, 170 USPQ 268 (CCPA 1971)."

See also MPEP 2163 II A 3(a): "An applicant may show possession of an invention by disclosure of drawings or structural chemical formulas that are sufficiently detailed to show that applicant was in possession of the claimed invention as a whole. See, e.g., *Vas-Cath*, 935 F.2d at 1565, PATENTABILITY 2163 2100-179 Rev. 6, Sept. 2007 19 USPQ2d at 1118 ("drawings alone may provide a 'written description' of an invention as required by Sec. 112*"); *In re Wolfensperger*, 302 F.2d 950, 133 USPQ 537 (CCPA 1962) (the drawings of applicant's specification provided sufficient written descriptive support for the claim limitation at issue)."

Although, the present application did not specifically use the terminology "electrocatalyzed polymerization" or "electropolymerization", it should be obvious to one skilled in the art from the body of the figures, data, and evidence provided in the present application that the methodology is not conventional electrodeposition by conventional voltammetry as described in Verbrugge, but rather electrocatalyzed polymerization followed by reduction. See the attached Declaration by Applicant Rathindra Bose. Thus, Applicants have amended the claims and specification to more accurately describe the invention, without adding

any new matter, as the modifications were inherently present to one skilled in the art.

For example, Figure 2 in the present application clearly demonstrates the deposition technique is based on electrocatalysis leading to polymerization of platinum complexes on carbon surfaces. In this Figure, the increase in peak current in successive cycles, as indicated by cycles 1, 2, 3 etc., shows dramatic increase in current compared to latter cycles. There is no reduction peak at -0.7 V for the first cycle, the distinct formation of the reduction peak became visible in cycle 3. This peak is due to formation a thin uniform platinum film due to electropolymerization which is the active electrocatalyst. This modified carbon surface coated with platinum thin film is the active electrode for the reduction of phosphate blue used in Figure 2 since a carbon electrode alone does not reduce the phosphate blue species.

For conventional electrodeposition of platinum, one would expect a slow growth in peak at -0.7 V, and the current in successive cycles would depend on the bulk concentration of the platinum phosphate complex. Therefore, the change in the magnitude of current between two successive cycles would either be constant (where the changes in bulk concentration of platinum complex in solution is negligible due to small amount of electrodeposition) or less due to the depletion of the substrates. This is due to the fact that the current in cyclic voltammetry, or linear voltammetry, linearly depends on the concentration of the electro-active species and square root of the scan speed as listed in the patent application.

Furthermore, when a thin-film formation is complete in the present invention, very little changes in peak current at -0.7 V were apparent beyond 5th

cycle, confirming the behavior of microelectrode in cyclic voltammetry that no further changes in the electrode surface were taking place and that the bulk electro-active species is quasireversibly reduced and oxidized without significantly depleting its concentration. The above observations can only be described by a process in which platinum complexes in solution were polymerized at the carbon surface and then were reduced to platinum on the same surface by application of potential. Once carbon surface is covered with a platinum thin-film, such polymerization no longer takes place since no changes in the voltammograms were observed. Therefore, **this process can best be described by reductive electropolymerization.** In fact, following the submission of the present patent application, Applicants have published an article entitled, "Electrocatalytic reduction of platinum phosphate blue on carbon surfaces: A novel method for preparing fuel cell electrode" which appeared in the Journal of Power Sources, 2006, vol.157, pp188-192. A copy of the article is also attached in the Declaration. See page 191 of the Discussion regarding reductive polymerization.

There are further differences between Verbrugge and the present invention. The present invention's electropolymerization is applied to anionic complexes unlike the cationic complex of Verbrugge; two such examples are shown in Table 1 in the application, $\text{Pt}_2(\text{NH}_3)_2(\text{PO}_4)_2^{2-}$ and PtCl_4^{2-} . Applicants used forward scan (cathodic scan) to form thin-films by reductive electropolymerization, and the reverse scans were used to reoxidize any platinum that might have deposited due to conventional electrodeposition. Such conventional electrodeposition by constant current or potential scan is detrimental to the surface. Applicants' technology can be applied in lower concentrations; there is not a low concentration limit. Also, the limitation of Applicants' invention is

that this methodology is applicable to any complexes (cationic, anionic, or neutral) as long as these complexes can be polymerized at the carbon surfaces.

Therefore, since the Verbrugge patent does not disclose coating a carbon article with a metal by reductively electropolymerizing the metal on the carbon article through cyclic voltammetry, thereby forming a metal coating on the carbon article as set forth in the presently pending independent claims, the claims are patentable over the Verbrugge patent and reconsideration of the rejection is respectfully requested.

Claims 6-12 stand rejected under 35 U.S.C. §102(b) as anticipated by or, in the alternative, under §103(a) as being unpatentable over the Verbrugge patent. As these claims are non-elected, this rejection is rendered moot.

Claims 13-18 and 22-23 stand rejected under 35 U.S.C. §102(b) as anticipated by the Verbrugge patent. As these claims are non-elected, this rejection is rendered moot.

Claims 6-12 stand rejected under 35 U.S.C. §102(b) as anticipated by or, in the alternative, under §103(a) as being unpatentable over U.S. Patent No. 5,501,915 to Hards, et al. As these claims are non-elected, this rejection is rendered moot.

Claims 13-23 stand rejected under 35 U.S.C. §102(b) as anticipated the Hards, et al. patent. As these claims are non-elected, this rejection is rendered moot.

Claims 19-21 stand rejected under 35 U.S.C. §103(a) as being unpatentable over the Verbrugge patent in view of U.S. Patent No. 5,084,144 to Reddy, et al. As these claims are non-elected, this rejection is rendered moot.


The remaining dependent claims not specifically discussed herein are ultimately dependent upon the independent claims. References as applied against these dependent claims do not make up for the deficiencies of those references as discussed above, and the prior art references do not disclose the characterizing features of the independent claims discussed above. Hence, it is respectfully submitted that all of the pending claims are patentable over the prior art.

In view of the present amendment and foregoing remarks, reconsideration of the rejections and advancement of the case to issue are respectfully requested.

The Commissioner is authorized to charge any fee or credit any overpayment in connection with this communication to our Deposit Account No. 11-1449.

Respectfully submitted,

KOHN & ASSOCIATES, PLLC

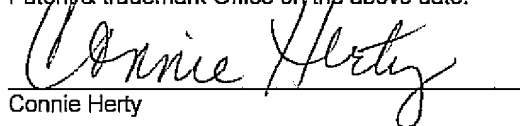

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